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A BEHAVIORAL STUDY OF THE SYLLABLE.

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ONE OF THE MOST IMPORTANT CONSIDERATIONS WHEN LEARNING OR TEACHING A FOREIGN LANGUAGE IS DETERMINING THE POSSIBILITIES OF PHONEME OVERLAP AND/OR INTERFERENCE BETWEEN THE NATIVE LANGUAGE AND THE TARGET LANGUAGE. ALTHOUGH TRADITIONAL METHODS OF CONTRASTIVE ANALYSIS HAVE RELIED ON MINIMAL PAIRS OF WORDS AND ISOLATING THE PHONEMES OF INITIAL OR FINAL POSITION, THE AUTHOR FEELS THAT A CONTRASTIVE ANALYSIS OF SYLLABLES MIGHT BE MORE INDICATIVE OF THE TYPES OF PROBLEMS THAT LANGUAGE STUDENTS WILL HAVE. TO TEST THIS HYPOTHESIS, AN EXPERIMENT WAS CONDUCTED WITH 25 MONOLINGUAL UNDERGRADUATE STUDENTS. A SERIES OF CHI-SQUARE TESTS WAS MADE TO INVESTIGATE ANY CORRELATION BETWEEN SYLLABLE ASSIGNMENTS MADE BY THE SUBJECTS AND THE VARIABLES OF STRESS, GEMINATION, AND VOICING. RESULTS OF THE EXPERIMENT INDICATED THAT, IN ENGLISH, THE WORD IS USEFUL TO DEFINE THE DISTRIBUTION OF ALLOPHONES, BUT THAT THE SYLLABLE IS A BETTER IDENTIFIER OF PHONEME DISTRIBUTION. (FB)

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# A BEHAVIORAL STUDY OF THE SYLLABLE

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In any language learning situation, the phonological and grammatical categories of the student's native language (N) are partially similar to and partially different from the competing linguistic categories of the target language (T) the student is attempting to learn. The partial similarities and partial differences of the competing categories are expected to cause pro-active interference in the learning of any second language. Linguists (e.g., Moulton, 1962 a and b; Stockwell and Bowen, 1965) have assumed that by a contrastive analysis of the N with the T the relevant categories could be defined precisely and, by comparing them, the areas and the degree of interference between the N and the T could be predicted.

Heretofore, in contrastive analyses comparing the N and the T phonological systems, the word has been used as one of the primes of analysis. For example, Lado (1957) and Politzer (1960) posited that the sound /ž/ (as in leisure, /liyžər/) would be difficult to learn for American English speakers learning any language in which this sound occurs in word initial position in the T, since /ž/ never occurs in word initial position in the N, American English.

However, in a recent experimental investigation of phonological interference (Brière, 1966 and forthcoming), the sounds/ž/ and /ŋ/ (as in ringing, /rɪŋɪŋ/, which, like /ž/, never occurs in word initial position in English) were presented in a composite language containing French (jouer, /žue/) and Vietnamese (ngao, /ŋao/) words, which monolingual American English speakers attempted to learn. The subjects had difficulty learning /ŋ/ in its new position in the T but displayed perfect positive transfer for /ž/, i.e., all Ss produced /ž/ on every trial thereby indicating that there was no learning problem involved at all.

Brière hypothesized that /ž/ and /ŋ/ have completely different distributions in English and that using the word as a prime of anaysis will not reveal this difference. Though both sounds do not occur in word initial position, it was posited that /ž/ occurs in syllable initial position but that /ŋ/ is always syllable final, e.g., the syllable break in /liyžər/ would be /liy#žər/ but the syllable break in /rɪŋɪŋ/ would be /rɪŋ#ɪŋ/ and never */rɪ#ŋɪŋ/.

It was further posited that any sound which occurred in syllable initial position in English would be easily learned by American English speakers in word initial position in the T whether the sound occurs in this position or not in the N. In other words, the "accidental" absence of this sound from word initial position in the



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N is not crucial in predicting interference between the N and the T. However, the absence of a given sound from the syllable initial position is crucial and any such sound now occuring in word initial position in the T will cause interference and present a learning problem.

It was therefore posited that using the word as the only prime (above the phoneme) in a contrastive analysis of competing phonological systems is inadequate and that information derived from using the syllable as an additional prime would be necessary for accurate prediction of pro-active interference.

The phonological unit called the syllable has been used as a prime in linguistic analyses for some time. Definitions or descriptions of the syllable have been given in terms of the distribution of vowels and consonants (O'Connor and Trim, 1953), in terms of acoustic parameters (Lehiste, 1960, 1961), in terms of juncture (Harris, 1952, Hill, 1958), and in terms of physiological correlates (Stetson, 1928, Pike, 1944). Whatever description of the syllable is used, the enumeration of the number of syllables in a given utterance is usually not a problem. Malmberg (1963, p. 65) says, "even a person without any linguistic training usually has a very clear idea of the number of syllables in a spoken chain." Furthermore, there is general agreement upon the location of the point at which one syllable ends and another begins when certain consonants occur together medially. Thus, Hill (1958) can state with confidence that the syllable boundary in an utterance such as jackpot /džækpat/ would fall between the /k/ and /p/ since the consonant cluster /kp/ never occurs initially or finally with a single vocalic nucleus in English. We can, then, accept the generalization which states that the syllable boundary in any polysyllabic utterance will separate all medial consonant sequences which do not adhere to the rules for concatanation of consonant clusters in American English.

However, in spite of the general agreement upon the number of syllables in a given utterance and the location of the syllable boundary between certain consonant sequences, there remains the serious problem of predicting the assignment of single intervocalic consonants to a preceding or following syllable. In an utterance such as Thomas /támәs/, all linguists would agree that there are two syllables but not all would agree whether the medial consonant /m/ should be assigned to the first syllable or to the second syllable. Since /m/ occurs in both initial and final positions in English, e.g., mom /mam/, the assignment of /m/ to the first or second syllable cannot be predicted in terms of distribution alone. Furthermore, a specific syllable assignment for /m/ cannot be predicted in terms of acoustic parameters, juncture, or physiological correlates.

In light of the hypothesis, previously stated, that there is a need for using the syllable as a prime in a contrastive anlysis of the N with any T, it becomes extrememly important to determine which specific consonants can or cannot be assigned to syllable initial position by the speakers of a given language.

To investigate the manner in which American English speakers actually assign intervocalic consonants to syllable initial or syllable final positions, the following experiment was conducted.

## METHOD

Subjects. The subjects (N = 25) consisted of undergraduate students at UCLA. All Ss were monolingual speakers of American English with no bilingual backgrounds in their families. Ss had a maximum of three years training in a foreign language. All Ss spoke the standard dialect as heard around Los Angeles and no speakers of other regional dialects were permitted in the study.

Corpus. The corpus consisted of a total of 156 words, 12 monosyllables (e.g., call), 42 polysyllables (e.g., mechanical), 102 disyllables (e.g., dozen). Regardless of the number of syllables in any word only one intervocalic consonant was being investigated in each word, for example the /p/ in capacity. The corpus was divided so that some of the words (80) had primary stress on the syllable immediately preceding and others (67) had primary stress on the syllable immediately following the consonant being investigated. All of the consonantal phonemes in American English were included in the corpus. Where possible each consonantal class was represented by both geminate and nongeminate spellings, e.g., labor has a nongeminate 'b', stress on first syllable and abbot has a geminate 'bb', stress on the first syllable.

Procedure. Ss were seated at a table with the experimenter. In front of the Ss were placed a microphone, a tape recorder, and a stack of 4 x 6 white cards. On each card was printed one word of the corpus in capital letters with equal spacing between the letters. The cards were arranged in random order. An electric metronome was placed nearby and set for 80 beats per minute. The experimenter instructed the Ss as follows: "Please read the words on the cards in front of you. Break the words into parts, if they have parts, and say each part to each beat of the metronome. Allow two beats between each word." Ss were then given the practice words nightmare, handful, talk, bedroom, metronome, and deep to see if they understood the assignment. When the Ss did indeed break metronome into three parts, nightmare, handful, and bedroom into two parts, and talk and deep into one part, the Ss were told to go ahead and "to allow only one part, per beat and to be sure to come to a complete stop after each part. Allow two beats between each word. Ready? Begin." Ss then turned over the cards in the order presented to them and, where possible, broke the stimulus words into different parts, each part given to one beat of the metronome.

After the entire list had been completed, Ss were then presented a random order of four words from the corpus chosen to represent utterances of 1, 2, 3, and 4 syllables, e.g., shoe, ringing,

collision, and nasality. Ss were simply asked to state how many syllables each word contained. The Ss performances on both tasks were recorded on the tape recorder.

The resulting tapes were judged by the authors. Inventory sheets for each S were kept. The inventory sheets were designed so that the Ss' assignments of each intervocalic consonant being investigated could be scored in one of three columns, 'I', 'II', or "B'. In other words, in the word cupid, for example, the p would have been assigned to the first syllable (I), cup-id, to the second syllable (II), cu-pid, or to both syllables (B), cup-pid.

In addition all of the Ss' individual pronunciations of all of the utterances were transcribed phonetically on separate charts. All of the individual inventory sheets were then collapsed onto one sheet designed to give the total number of syllable assignments by all Ss for syllables 'I', 'II', or 'B', for every consonant that had been investigated.

A series of chi square tests were made to see if there was any significant relationship between the syllable assignments made by the Ss and the variables of stress, gemination and voicing. In addition, chi square tests were made to determine the relationship between syllable assignments and various phonetic classes such as 'stops' versus 'sibilants'.

## RESULTS

(1) The intervocalic consonants which were investigated were assigned as follows: 141 assignments to I, 2,635 assignments to II, and 824 assignments to B.

(2) /ŋ/ was assigned completely differently from all of the other consonants investigated, viz., 77 assignments to I, 0 assignments to II, and 23 assignments to B.

(3) There was a significant increase of assignments of the class of liquids, /l,r/, to B; 29 to I, 143 to II, and 253 to B. $\chi^2$ (2 dfs) = 63.69. $P < .001$

(4) There was a significant incre-se of assignments of interdentals, /θ,ð/, to B; 5 to I, 189 to II, and 106 to B. $\chi^2$ (2 dfs) = 37.88. $P < .001$

(5) When gemination was isolated as the only variable, there was a significant increase of assignments to B for stops and /m/. $\chi^2$ (2 dfs) = 43.13. $P < .001$

(6) When stress was isolated as the only variable, there was a significant increase of assignments to B for liquids. $\chi^2$ (2 dfs) = 25.24. $P < .001$

Though the experiment was not designed to investigate the next three results, the observations reported and discussed below are relevant to the study of American English segmentals.

(7) Ss only produced aspirated allophones of the voiceless stops in syllable initial.

(8) Affricates were treated as unit phonemes.

(9) "Checked" vowels actually did occur in open syllables.

## DISCUSSION

If a particular sound being investigated was assigned to syllable II after a break or was assigned to B(oth), I and II, with a clear break in between, then that particular sound category occurs syllable initial. On the other hand, if a sound is consistently assigned to syllable I before the break or assigned to B(oth) as a glide, i.e., without a clear break in between I and II, then we say that this sound occurs syllable final only. On the basis of this definition, all of the consonants which were investigated occur syllable initial except /ŋ/ and all of the consonants which occur syllable initial also occur word initial, except /ž/.

It is important to note that although there were 23% of the assignments of /ŋ/ attributed to B, this classification represented a glide rather than an actual break between syllables I and II. In other words, the velar was lengthened at the end of the first syllable but there were no occasions whatsoever of /ŋ/ being produced after a pause.

TABLE 1

| | Syllable I | Syllable II | B(oth) Syllables |
|---|---|---|---|
| All Consonants | 141 = (3.9%) | 2,635 = (73.2%) | 824 = (22.9%) |
| /ŋ/ | 77 = (77%) | 0 = (0%) | 23 = (23%) |
| /ž/ | 1 = (.08%) | 107 = (85.6%) | 17 = (13.6%) |
| /l,r/ | 29 = (.07%) | 143 = (33.6%) | 253 = (59.5%) |
| /θ,ð/ | 5 = (1.7%) | 189 = (63%) | 106 = (35.33%) |

Table 1: Actual assignments of consonants converted to percentages of the total of a given class.

A glance at Table 1 confirms the fact that /ŋ/ is distributed completely differently from the other consonants, i.e., /ŋ/ never occurs syllable initial, whereas /ž/ is distributed essentially the same as all other American English consonants in that /ž/ also occurs syllable initial. This confirms the original hypothesis that /ŋ/ will represent a

learning problem for American English speakers who attempt to learn a language which has /ŋ/ in word initial position but /ž/, since it occurs in syllable initial position, will not present a learning problem even when it occurs word initial in the target language. In other words, in the case of /ŋ/ and /ž/, information derived from using the syllable as an encoding unit is necessary in any contrastive analysis of American English with a target language to insure accurate predictions of proactive interference in phonology.

The need for using the syllable as one of the units in a contrastive analysis does not, however, mean that the word can be disregarded as a unit. Frequently information that is important in predicting interference in learning a second language can only be gained by considering multiple syllable forms, for example, the distribution of allophones in a language is described in terms of units that are longer than just a single syllable.

In American English, the phoneme /t/ has an unaspirated flap allophone which occurs intervocalically after a stressed syllable, e.g., city, [sɪɾɪ], and an aspirated allophone which occurs word initial, e.g., tin, [thɪn]. However, when the Ss were forced to break a word such as city into two syllables, they pronounced both syllables with equal stress and they substituted the aspirated allophone for the flap, [sɪ#thɪ].

Thus, in general, the allophone which can occur in syllable initial is the one that occurs in word initial, except for [ž]. To the extent that the generalization holds true for other languages, in a contrastive analysis of consonants, we should use word as a prime to define the distribution of allophones but use syllable as a prime to define the distribution of phonemes.

In defining the distribution of vowels in American English, the use of syllables seems to be equally important. Hans Kurath (1964) states that "checked vowels.../ɪ,ɛ,æ,...U/, as in bid, bed, bad,...good...do not occur at the end of morphemes; they are always followed by one or two consonants." (p. 17)

From our transcriptions of the Ss responses, however, we were able to make the following observations. When Ss were forced to break words into two or more parts, the so-called "checked" vowels did, in fact, frequently occur in syllable final, i.e., in open syllables as unchecked vowels. When the consonant assignment was to syllable II, the Ss produced the "checked" vowels of the first syllable in one of three ways, viz., (1) ...V?#, i.e., checked by a glottal stop (?) before the break (#); (2) ...Vh#, i.e., followed by a devoicing (h) of the vowel; (3) ...V#, i.e., simply as a completely unchecked vowel in open syllable. For example, for the stimulus word rapid /ræpɪd/, all of the following forms were recorded /ræ?#pɪd/, /ræh#pɪd/, and /ræ#pɪd/.

TABLE 2

| | Vowel # | Vowel ?# | Vowel h# | Total |
|---|---|---|---|---|
| /ɪ/ | 12<br>27.9% | 23<br>53.5% | 8<br>18.6% | 43 |
| /ɛ/ | 34<br>37.7% | 19<br>21.1% | 37<br>41.1% | 90 |
| /æ/ | 123<br>76.9% | 23<br>14.4% | 14<br>8.7% | 160 |
| /U/ | 15<br>62.5% | 6<br>25.0% | 3<br>12.5% | 24 |

Table 2: "Checked" vowels in syllable final; raw scores and percentages of the individual totals.

The above observation that so-called "checked" vowels can occur in syllable final suggests that further research should be conducted concerning the distribution of vowels within American English because of the importance to the theory of contrastive analysis. If a "checked" vowel can occur in syllable final, then one would predict that when an American English speaker is learning a language in which these vowels occur in open syllables, e.g., French mais /mɛ/, then no interference should ensue due to the vowel distribution in the native language.

One interesting result of this experiment, although only of marginal importance to contrastive analysis, was the Ss treatments of affricates.

The phonemic status of the affricates /č/, as in chin /čɪn/, and /ǰ/, as in gin /ǰɪn/, has been debated for over fifty years. The problem has been whether to analyze /č/ and /ǰ/ as single unit phonemes or sequences of the sounds /t/ plus /š/ for the former and /d/ plus /ž/ for the latter. Bloomfield (1933) established /č/ as a single unit phoneme on the basis of the contrastive pair of utterances white shoes /hwaitšuz/: why choose /hwaɪčuz/. However, some years later, Bloch and Trager (1940) posited that the establishment of /č/ and /ǰ/ as single unit phonemes was unnecessary. They introduced the concept of 'plus juncture' (+) into phonological theory and demonstrated that the distinguishing factor in Bloomfield's test pair could be attributed to the placement of the plus juncture rather than to a difference between a single unit phoneme and a sequence of phonemes, i.e., white shoes, /hwait+šuz/, and why choose, /hwai+tšuz/. Since that time, many linguists have disagreed on the way to analyze the affricates, although most American linguists still treat /č/ and /ǰ/ as single unit phonemes.

In this experiment, Ss were given 346 opportunities to divide words containing the sequences /tš/ and /dž/. There was not one single instance in which any S separated the first and second elements

of these sequences. For example, the words 'teacher' and 'magic' were never divided into the sequences /tiyt+šər/ or /mæd+žɪk/--although /t/, /d/, /š/, and /ž/ are demonstrably permissible syllable final and syllable initial phonemes. Out of the 346 occasions the Ss assigned the affricates to syllable I sixteen times /tiytš#ər/ and /mædž#ɪk/ and to syllable II three hundred and thirty times /tiy#tšər/ and /mæ#džɪk/.

It might be argued that the only reason Ss treated affricates as single unit phonemes is that all of the stimulus words in the corpus contained single, intervocalic consonants only. There were no intervocalic consonant clusters which the Ss would naturally break into two distinct parts, e.g., in the word compare, the intervocalic cluster would undoubtedly be broken into two parts, com#pare, rather than be treated as a single unit assigned to syllable I, comp#are, or to syllable II, co#mpare.

An additional experiment should be conducted in which the stimulus words contain some single intervocalic consonants but a majority of intervocalic consonant clusters of the type that would encourage dividing the syllables between the consonants. If Ss continue to treat the affricates as they did in the experiment reported here, then there would seem to be little doubt that, in behavioral terms, /č/ and /ǰ/ are used by speakers of American English (in both syllable initial and in syllable final) as single unit phonemes.

## SUMMARY

This study attempts to show that the comparison of the competing phonological systems in a contrastive analysis requires the use of the syllable as an additional prime. In this experiment Ss were forced to orally break words, presented as visual stimuli, into syllables. The Ss' assignments of intervocalic consonants to the preceding or following syllables were recorded. The results proved conclusively that, in American English, /-ŋ/ always occurs syllable final but that /ž/ occurs syllable initial thus creating interference and facilitating transfer, respectively, when these sounds occur word initial in a target language. These predictions would not be possible on the basis of the use of the word as the only prime above the phoneme. Suggestions for further research are made on the basis of the observations that "checked vowels" did occur in syllable final; that affricates were treated as single unit phonemes; and that, except for [ž], only word initial allophones occur in syllable initial.

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